AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method of analyzing an engine unbalance condition, the method comprising:

receiving vibrational data from a plurality of locations distributed over at least one of an engine and a surrounding engine support structure;

inputting the vibrational data into an ~~ANNCV~~ artificial neural network control volume (ANNCV);

using ~~the~~ a neural network inverse model, establishing a relationship between the vibrational data from the plurality of locations and an unbalance condition of the engine; and

outputting diagnostic information from the ANNCV, the diagnostic information indicating the unbalance condition of the engine, the diagnostic information including an unbalance magnitude and an angular location as a function of a rotational frequency of the engine.

2. (Cancelled)

3. (Currently Amended) The method of Claim 1, wherein the vibrational data ~~consist of~~ includes at least one measurement of component displacement, component velocity, component acceleration, sound pressure, and acoustic noise.

4. (Currently Amended) The method of Claim 1, wherein inputting the vibrational data into ~~an~~ the ANNCV includes inputting the vibrational data in a time domain format into ~~an~~ the ANNCV.

5. (Currently Amended) The method of Claim 1, wherein inputting the vibrational data into ~~an~~ the ANNCV includes inputting the vibrational data in a complex frequency domain format into ~~an~~ the ANNCV.

6. (Original) The method of Claim 1, further comprising subjecting the vibrational data to a Pre-processing Transformation.

7. (Currently Amended) The method of Claim 6, wherein ~~subjecting~~ the ~~vibrational data to a~~ Pre-processing Transformation ~~consisting of~~ includes a Fourier Transform.

8. (Currently Amended) The method of Claim 6, wherein ~~subjecting~~ the ~~vibrational data to a~~ Pre-processing Transformation ~~consisting of~~ includes Wavelet Transforms.

9. (Currently Amended) The method of Claim 6, wherein subjecting the vibrational data to a Pre-processing Transformation consists of applying a Fourier Transformation that includes framing an FFT block size using the once per revolution signal such that leakage effects are at least partially reduced, which is also known as order tracking.

10. (Currently Amended) The method of Claim 6, wherein inputting the vibrational data into ~~an~~ the ANNCV includes inputting the vibrational data in a complex frequency domain format into ~~an~~ the ANNCV.

11. (Original) The method of Claim 1, wherein outputting diagnostic information from the ANNCV includes outputting fan unbalance and angular location data, and low pressure turbine unbalance and angular location data.

12. (Original) The method of Claim 1, wherein establishing a relationship between the vibrational data from the plurality of locations and an unbalance condition of the engine includes establishing a relationship between the vibrational data from the plurality of locations

and an unbalance condition of the engine using at least one of a multilayer perceptron neural network mode, and a support vector machine neural network model.

13. (Original) The method of Claim 1, further comprising training the neural network inverse model.

14. (Original) The method of Claim 13, wherein training the neural network inverse model includes adjusting model parameters such that application of a set of inputs and outputs reaches a desired state of definition defined by acceptable error tolerances.

15. (Original) The method of Claim 13, wherein training the neural network inverse model includes inputting vibrational data to the ANNCV generated by an empirical engine model.

16. (Original) The method of Claim 13, wherein training the neural network inverse model includes inputting vibrational data to the ANNCV generated using an engine that is subject to residual unbalances and to applied trial weight unbalances.

17. (Original) The method of Claim 13, wherein training the neural network inverse model includes scaling the vibrational training data prior to inputting into the ANNCV.

18. (Currently Amended) A computer program product for analyzing an engine unbalance condition, the computer program product comprising:

a first computer program portion adapted to receive vibrational data from a plurality of locations distributed over at least one of an engine and surrounding engine support structure;

a second computer program portion adapted to input the vibrational data into an ~~ANNCV~~ artificial neural network control volume (ANNCV);

a third computer program portion adapted to establish a relationship between the vibrational data from the plurality of locations and an unbalance condition of the engine using a neural network inverse model; and

a fourth computer program portion adapted to output diagnostic information from the neural network inverse model, the diagnostic information indicating the unbalance condition of the engine by indicating a quantity and an angular position of corrective engine balance weights to achieve desirable vibrational characteristics at selected aircraft component and cabin locations.

19. (Cancelled)

20. (Original) The computer program product of Claim 18, wherein the fourth computer program portion is adapted to output a vibrational magnitude as a function of a rotational frequency of the engine.

21. (Currently Amended) The computer program product of Claim 18, wherein the second computer program portion is adapted to input the vibrational data in a time domain format into ~~a~~ the neural network inverse model.

22. (Currently Amended) The computer program product of Claim 18, wherein the second computer program portion is adapted to input the vibrational data in a complex frequency domain format into ~~a~~ the neural network inverse model.

23. (Previously Presented) The computer program product of Claim 18, wherein at least one of the first, second, and third computer program portions is adapted to subject the vibrational data to a Fourier Transformation.

24. (Original) The computer program product of Claim 18, wherein at least one of the first, second, and third computer program portions is adapted to extract a desired once per revolution vibrational data for order tracking signal processing purposes.

25. (Original) The computer program product of Claim 18, wherein at least one of the first, second, and third computer program portions is adapted to subject the vibrational data to a Wavelet Transformation.

26. (Original) The computer program product of Claim 18, wherein the third computer program portion is adapted to establish a relationship between the vibrational data from the plurality of locations and an unbalance condition of the engine using at least one of a multilayer perceptron neural network model and a support vector machine neural network model.

27. (Original) The computer program product of Claim 18, wherein the third computer program portion is adapted to establish a relationship between the vibrational data from a plurality of locations within one defined area to that of a plurality of locations within another defined area using at least one of a multilayer perceptron neural network model and a support vector machine neural network model.

28. (Original) The computer program product of Claim 18, wherein the third computer program portion is adapted to be trained.

29. (Original) The computer program product of Claim 28, wherein the third computer program portion is adapted to be trained including adjusting model parameters such that application of a set of inputs and outputs reaches a desired state of definition defined by acceptable error tolerances.

30. (Original) The computer program product of Claim 28, wherein the third computer program portion is adapted to be trained including inputting vibrational data generated using an engine that is subject to at least one of residual unbalances and applied trial weight unbalances.

31. (Original) The computer program product of Claim 28, wherein the third computer program portion is adapted to be trained including scaling the vibrational training data prior to inputting into the neural network inverse model.

32-57. Cancelled

58. (Currently Amended) A method of analyzing an engine unbalance condition, the method comprising:

collecting at least one vibrational data signal from a plurality of sensors distributed over at least one engine and a surrounding engine support structure;

inputting at least one signal into an ~~ANNCV~~ artificial neural network control volume (ANNCV);

analyzing the signal to identify an engine unbalance condition; and

outputting diagnostic information from the ANNCV, derived from the unbalance condition, the diagnostic information including an unbalance magnitude and an angular location as a function of a rotational frequency of the engine.